Forecasting weather for military aviation

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· Est. 1866 to warn of severe weather
· Our mission: Protection of life and property
·Weather forecasting, climate monitoring and research
·Severe weather warnings
·Ocean and ice service
·Meteorological aviation services – civil and military
·Emergency preparedness
·Collaborate on special services
·Commercial services

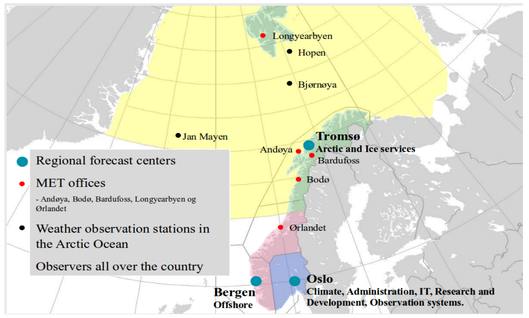

Figure 1. Geographical responsibility

International role
- •First in Europe to provide free weather and climate data to the population
  - •YR is the 5th largest website in the world
- •Capacity building with focus on weather and climate information in Bangladesh, Myanmar and Vietnam

Member of:
- The World Meteorological Organization (WMO)
- The European Centre for Medium Range Weather Forecasts (ECMWF)
- The European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)

Ørland Weather Office

Photo: Ørland Weather Office is located in the third floor of the air traffic control tower. 338 sq. F-16 in front Photo credit: Kallestad, Gorm/Scanpix

Temperature and precipitation measurements since 1895, weather office since 18th October 1954.
Provides weather forecasts to the Norwegian air force, NATO and affiliates
338 sq. - F16 jet fighters, from 2017: F-35.
330 sq. - Westland Sea King; search and rescue helicopters
335 sq. - Transport squadron, operates C-130J Hercules planes
717 sq. - Electronic warfare, navigation control, VIP transport, operates Dassault DA-20 Jet Falcon
AWACS – Airborne Warning Control System; radar surveillance, command & control, modified Boeing 707
Swiss AF – F5 jet fighters.

Some local products

·Weather package (face to face presentation to pilots) includes:
- ·Analysis, radar image
- ·Significant weather charts (surface to tropopause)
- ·Airfield cross section
- ·Cloud distribution charts
- ·Wind maps

·Local airfield forecast and observations (TAF, METAR & TREND)

TAF – Terminal Aerodrome Forecast
- 24 hr airfield forecast issued every 6 hours

METAR - «MÉTéorologie Aviation Regulière»
- Observation of airfield weather every 30 mins (day), or hour (night)

TREND
- 2 hour forecast attached to METAR

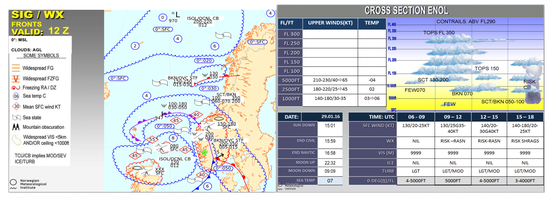

Figure 2, left: Example of significant weather chart (29.01.2016). The low pressure on the chart is the storm named 'Tor' by Norwegian Met. Inst./named 'Gertrude' by UK Met Office.
Right: Example of airfield cross-section (29.01.2016) from a weather package (as presented to the pilots). Note: Upper level winds above 5000 feet were excluded on this date, due to no scheduled activity by 338 sq.

Models & ECMWF data usage

·ECMWF data usage is currently sparse and limited to
- ·making significant weather charts for NATO AWACS missions with destinations outside the domain of the most commonly used models (Arome-MetCoop, Hirlam 8km & 12km)
- · Or for the occasion when a long range forecast is needed, typically only for local weather.

· Thus, ECMWF data is not used as much, because currently models with better horizontal and vertical resolution are available
·By 11th march the Hirlam models will be phased out, and will in part be replaced by ECMWF data with ~9km horisontal resolution (IFS cycle 41r2).

Photo: 330 sq. Westland Sea King in operation during practice. Credit: Johan Wildhagen

·Use of ECMWF data in cooperation with the Arome MetCoop 2.5 km model is expected to increase.
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Arome-MetCoop model
Based on Harmonie v. cy38h1.1
65 layers, 2.5 km horizontal resolution
Non-hydrostatic dynamics
Updated with boundary conditions from ECMWF every hour
Run every 6th hour (00,06,12 and 18UTC)
Post-processing of precipitation, clouds, temperature, wind and 'thunder'

Issues with military aviation forecasting

·Requires high precision on wind speed forecasting, in particular on runway cross wind directions, due to pilot and/or aircraft limitations
· Forecasting convective weather, frequency and intensity of showers, in particular showers of snow due to their effect on horizontal and vertical visibility
·Fog and freezing fog
·Icing
·Wind shear, turbulence and mountain waves
- ·Wind in complex terrain (rescue helicopters)

·Cloud distributions in the horizontal and vertical from the surface to the tropopause
- ·Once in the air, the jet fighter pilot mostly only cares about cloud distribution; "Can I see the ground?"
- · Interpretation of model soundings is very frequently used

·Upper level haze; a phenomena identified by jet fighter pilots that greatly reduces horizontal visibility, but has little to no impact on vertical visibility.

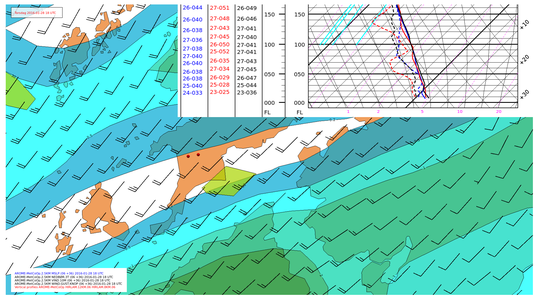

Figure 3. Model shows runway crosswind 240/20-25KTS at surface, and usually underestimates wind speed. F-16 take off threshold on crosswind = 25KTS.

Will the wind speed exceed the threshold on take off time?

Model data from Arome-MetCoOp 2.5 km model, dated january 28th, 18UTC.

Photo, upper left: F-16 landing with parachute in freezing fog, Ørland. Credit: Capt. Helge Hopen, Norwegian Air Force.

Bottom left: F-35 Lightning II at Luke Air Force Base. Credit: US Air Force.

Right: F-16 flying in formation above clouds. Credit: Morthen Hanche, Norwegian Air Force.

Some of my colleagues

Photo: From the weather office's stand in connection with its 60-year anniversary. From left to right: Espen Karlsen, John Furre, Elin Tronvoll, Lillian Drilen, Thor Bretting.
Photo credit: Elin Tronvoll.